

UNITED STATES MARINE CORPS
Basic Officer Course
The Basic School
Marine Corps Combat Development Command
Quantico, Virginia 22134-5019
B1410

TERRAIN ANALYSIS

Student Handout

1. **Map Design Guidelines.** What the mapmaker was considering when he designed the map.
 - a. Selection. Choosing features to be shown on the map.
 - b. Classification. Grouping together of similar features.
 - c. Simplification. Reducing amount of detail on map.
 - d. Magnitude. Shows relative size, use and permanence of related features.
2. **Terrain Association Factors.** What the user must consider each time he picks up a map.
 - a. Contour interval. This provides information on the amount of detail shown on landforms. It is extremely important during the planning stage of any operation.
 - b. Map date. The information provided by the map is only as good as the date it was compiled.
 - c. Map region. Knowledge of the region covered by the map will provide a clearer idea of what you can expect to see in the real world and on the map.
 - d. Season. The changing seasons will affect what you see in the real world and your ability to match what you see to the map.
3. **Describing Landforms (SOSES)**
 - a. Shape. General form or outline of feature.
 - b. Orientation. Direction of feature with respect to your viewpoint. They are either in line, across, or at an angle to your viewpoint.
 - c. Size. Length or width of feature across its base.
 - d. Elevation. Height of landform above sea level or a common datum.
 - e. Slope. Steepness of sides of landform.
4. **Landforms**

FEATURE	SHAPE	ORIENTATION	SIZE	ELEVATION	SLOPE
Hill	Round	N/A	Varies with distance across base	Varies	Varies
Ridge	Elongated	Across, In line, at angle	Varies with distance across base	Varies	Varies
Finger (Spur)	Elongated	Combined terms	Varies	N/A	Varies
Saddle	Hourglass	N/A	Distance between tops	Varies	Varies
Draw	Elongated	Combined	Varies	N/A	Varies

5. **Determination of Elevation**

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- a. Look at the contour interval.
- b. From the designated point find the nearest index contour line.
- c. Determine if the index contour line is up or down slope from the designated point.
- d. Count the number of contour lines from the designated point to the index contour line. Multiply by the contour interval to calculate the change in elevation (up or down) from the designated point to the index contour line.
- e. Add (or subtract) the change in elevation, as appropriate, to (or from) the index contour line.
- f. If the designated point is between contour lines, add one-half of the contour interval to the lower contour line.
- g. Other methods of determining elevation:
 - (1) Bench marks
 - (2) Horizontal control points
 - (3) Road intersections
 - (4) Other spot elevations

6. **Types of Contour Lines**

- a. Index. Heavy brown lines with elevations shown.
- b. Intermediate. Lighter brown lines between index contours.
- c. Supplementary. Broken light brown lines drawn in to provide more information. Elevation is one-half of the contour interval added to the next lower contour.
- d. Depression. Tick marks point down.
- e. Cliff

7. **Types of Slope**

- a. Uniform steep
- b. Uniform gentle

c. Concave

d. Convex

8. **Summary of Landform Types**

APPENDIX AREQUIREMENT 1

Map: Margarita Peak, California, 1:50,000, Sheet 2550 IV, Series V795, Edition 8-NIMA.

Section 1Identification of Landforms

1. Identify the following landforms:

- | | | |
|---------|-------------------|------|
| a. | 63818564 | ANS. |
| _____b. | 73079585 | ANS. |
| c. | 72869515-73359635 | ANS. |
| d. | 72509415-72209430 | ANS. |
| e. | 73010372 | ANS. |
| f. | 70708758 | ANS. |

Elevation

2. Determine the elevation of the following points:

- | | | |
|----|------------------------------|------|
| a. | 69479485 | ANS. |
| b. | 66379515 | ANS. |
| c. | road intersection in GS 6492 | ANS. |
| d. | 67648890 | ANS. |
| e. | 62469745 | ANS. |

Terrain Analysis

Draw a straight line from coordinate (1) to coordinate (2) and provide the following information:

- | | |
|----|--|
| a. | List all landforms starting with the landform at the first coordinate. |
| b. | Give the ground distance, along the line, from each landform to the next to the nearest 20m. |
3. From (1) 73119587 to (2) 72599514:

<u>Landform</u>	<u>Distance to next landform</u>
-----------------	----------------------------------

- | | |
|----|-------|
| a. | _____ |
| b. | _____ |
| c. | _____ |
| d. | _____ |

4. From (1) 67148260 to (2) 67998322:

<u>Landform</u>	<u>Distance to next landform</u>
-----------------	----------------------------------

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- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

Section 2

Identification of Landforms

1. Identify the following landforms:

- a. 73419675 ANS.
- b. 65859654 to 65459696 ANS.
- c. 68109579 to 68099609 ANS.
- d. 74890395 to 74650433 ANS.
- e. 69658095 ANS.

Elevation

2. Determine the elevation of the following points:

- a. BM in GS 7590 ANS.
- b. 59549830 ANS.
- c. 60400094 ANS.
- d. 65340195 ANS.
- e. 57578305 ANS.

Slope

3. Determine the kind of slope between the following points:

- a. 54448881 to 54298909 ANS.
- b. 56680423 to 56250435 ANS.
- c. 59500252 to 60160231 ANS.
- d. 60179304 to 60369355 ANS.
- e. 69029441 to 69349467 ANS.
- f. 62690160 to 63140185 ANS.
- g. 65849863 to 65999928 ANS.
- h. 72548282 to 73168322 ANS.

REQUIREMENT 1 SOLUTIONSection 1Identification of Landforms

1.
 - a. hill
 - b. saddle
 - c. draw
 - d. finger
 - e. hill
 - f. depression

Elevation

2.
 - a. 265m
 - b. 325m
 - c. 110m
 - d. 143m
 - e. 765m

Terrain Analysis

<u>Landform</u>			<u>Distance to next landform</u>
3.	a.	saddle	180m \pm 20m
	b.	hill	350m \pm 20m
	c.	draw	300m \pm 20m
	d.	finger	N/A
4.	a.	draw	350m \pm 20m
	b.	finger	250m \pm 20m
	c.	draw	150m \pm 20m
	d.	finger	350m \pm 20m
	e.	draw	N/A

Section 2Identification of Landforms

1.
 - a. hill
 - b. draw
 - c. finger
 - d. saddle
 - e. hill

Elevation

2.
 - a. 221.6m
 - b. 530m
 - c. 690m
 - d. 790m
 - e. 30m

Slope

3.
 - a. uniform gentle
 - b. uniform steep
 - c. convex
 - d. concave
 - e. convex
 - f. concave
 - g. uniform steep
 - h. uniform gentle

APPENDIX BREQUIREMENT 2

Map: Quantico, 1:50,000, Sheet 5561 III, Series V734, Edition 6-DMA

Identification of Landforms

1. Identify the following landforms:

- | | | |
|----|----------------------|------|
| a. | 83587630 | ANS. |
| b. | 87137504 | ANS. |
| c. | 93616752 | ANS. |
| d. | 93326720 | ANS. |
| e. | 84517778 to 84807758 | ANS. |
| f. | 86647510 to 87057566 | ANS. |
| g. | 86497495 to 86607467 | ANS. |
| h. | 89367610 | ANS. |
| i. | 84737847 | ANS. |
| j. | 89217732 to 89547713 | ANS. |

Elevation

2. Determine the elevation of the following points:

- | | | |
|----|----------|------|
| a. | 84807480 | ANS. |
| b. | 85467451 | ANS. |
| c. | 83587630 | ANS. |
| d. | 85657395 | ANS. |
| e. | 88107440 | ANS. |
| f. | 84257654 | ANS. |
| g. | 85007700 | ANS. |
| h. | 89257570 | ANS. |
| i. | 86007234 | ANS. |
| j. | 84476953 | ANS. |

Terrain Analysis

Draw a straight line from coordinate (1) to coordinate (2) and identify the following along each line:

- a. Name all features. Give a directional axis of all linear landforms.
- b. Give the ground distance, along the line, from each landform to the next landform to the nearest 20m. (Use the paper strip method)

3. From (1) 86677246 to (2) 86397290:

<u>Landform</u>	<u>Axis</u>	<u>Distance to Next Landform</u>
a. _____		_____
b. _____		_____
c. _____		_____
d. _____		_____

4. From (1) 92816784 to (2) 93656709:

<u>Landform</u>	<u>Axis</u>	<u>Distance to Next Landform</u>
a. _____		_____
b. _____		_____
c. _____		_____
d. _____		_____

5. What slope is shown by the contour lines between the following sets of coordinates?

- 96386408 to 96406440
- 96636404 to 96716420
- 94307340 to 94697336
- 84856989 to 84166960
- 92788480 to 92888510
- 89958700 to 89788733

REQUIREMENT 2 SOLUTIONIdentification of Landforms

1.
 - a. hill
 - b. hill
 - c. saddle
 - d. hill
 - e. draw
 - f. finger
 - g. finger
 - h. hill
 - i. saddle
 - j. draw

Elevation

2.
 - a. 125m
 - b. 125m
 - c. 115m
 - d. 115m
 - e. 75m
 - f. 115m
 - g. 115m
 - h. 115m
 - i. 115m
 - j. 115m

Terrain Analysis

	<u>Landform</u>	<u>Axis</u>	<u>Distance to Next Landform</u>
3.	a. finger		NE->SW 100m \pm 20
	b. draw		NE->SW 100m \pm 20
	c. finger		NE->SW 300m \pm 20
	d. draw		E->W N/A
4.	a. finger		N->S 500m \pm 20
	b. draw		NE->SW 400m \pm 20
	c. saddle		N/A 200m \pm 20
	d. draw		NE->SW N/A

Slope

5.
 - a. concave
 - b. uniform steep
 - c. convex
 - d. uniform gentle
 - e. convex
 - f. concave

APPENDIX CREQUIREMENT 3

Map: Inchon, 1:50,000, Sheet 3120 IV, Series L754, Edition 2 - NIMA

LANDNAV INCHON

General Situation. Using the 1988 Olympic Summer Games to break the ice of the Cold War between North and South Korea, negotiations progressed rapidly for force reductions on both sides. Lacking sophisticated means to confirm North Korea's intentions, the South Korean government was caught unprepared when 11 North Korean divisions streamed over the DMZ. The South Koreans immediately requested American assistance.

Special Situation. You are a platoon commander in Company G, 2d Battalion, 9th Marines. Your battalion, the Air Contingency Battalion on Okinawa, immediately flew into an airport north of Incheon with the mission to defend port facilities to allow future 3d Marine Division units to debark from amphibious shipping.

Requirement. Note: All problems should be done in the order listed. Assume declination on map is current.

1. What is the contour interval of your map? ANS.
2. If the airfield your battalion used to land is located on the map sheet directly north of the Incheon map sheet, what map series and sheet number would you request from the S-2 (Intelligence Officer) in order to see it?

ANS.

ANS.

3. After having set up an antimechanized ambush in grid square 0150 at the westernmost intersection of the two all-weather, hard surface roads, you are ordered to send a squad by helicopter to grid square 0148 where the power transmission line intersects the all-weather, hard surface road. What is the horizontal distance, in meters, that the helicopter must fly to reach the transmission line/road intersection from the original road intersection?

ANS.

4. Along what grid azimuth must the squad leader instruct the pilot to fly from the road intersection to the transmission line/road intersection (see previous problem)? What magnetic azimuth must the helicopter follow?

ANS.

ANS.

5. At the last minute, the helicopter is reassigned to another mission and your squad must march to their new position. If they follow the all-weather, hard surface road, how far must they march from the road intersection to reach the transmission line?

ANS.

6. How many heliports are there in grid square 9950?

ANS.

7. While inspecting your platoon position at the all-weather, hard surface road junction in grid square 0150, you receive harassing sniper fire from the school in grid square 0350. You decide to call mortar fire to harass him back. Part of the call for fire you will send is the azimuth from your position to the target. What is the grid azimuth from your road junction to the school?

ANS.

8. Another part of your call for fire is your estimated range to your target. How far is the school in meters from your road junction? (See previous problem.)

ANS.

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9. Your battalion intelligence officer suspects that there is an enemy forward observer in GS 0448. The battalion operations officer has tasked your company to send a patrol into the GS to attempt to locate the enemy. Your company commander tasks you to lead the patrol. What types of vegetation will you encounter in that grid square?

ANS.

10. How many buildings are there in GS 0146?

ANS.

11. Your squad in GS 0046 must prepare demolition charges to "blow" the bridge in GS 9946. In order for you to request the optimum type of explosive from the S-4 (Logistics Officer) you must analyze the bridge. What is the primary construction material in the bridge?

ANS.

12. Your platoon is tasked to set up a blocking position at the intersection of Routes 42 and 397 in GS 1041. Helos will fly you to the heliport in GS 0842. From there, trucks will take you to your destination. How far, in meters, will you ride in the trucks?

ANS.

13. After dark, you are ordered to send a squad-sized patrol to hill 166 in GS 1240 to investigate small arms fire. Since there is a possibility of your squad being captured, you are ordered not to allow them to take a map. What magnetic azimuth do you tell your squad leader to follow from the intersection of Routes 42 and 397 in GS 1041 to move directly to hill 166?

ANS.

14. Your squad leader reaches hill 166 and reports it as all secure. Using his night vision goggles, he also reports a large concentration of North Korean T-72 tanks on a magnetic azimuth of 120 degrees at an estimated range of 3000m. What map series and sheet number must you request to see the area of collected enemy forces?

ANS.

15. Having learned of the strong armor threat, you instruct your patrol squad leader to conduct a bridge reconnaissance of the two concrete bridges over streams on Route 351 in GS 0942 and report to you about their structural stability. What magnetic azimuth do you instruct him to follow from hill 166 in GS 1240 to reach the more northern of the two bridges?

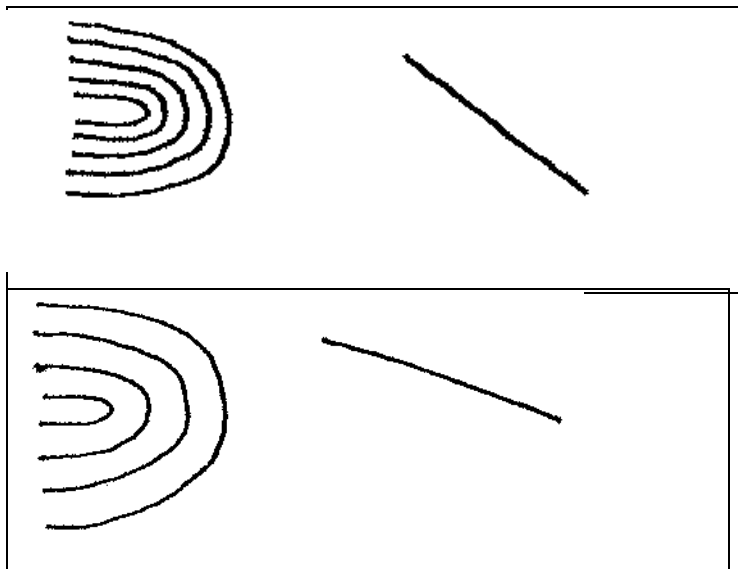
ANS.

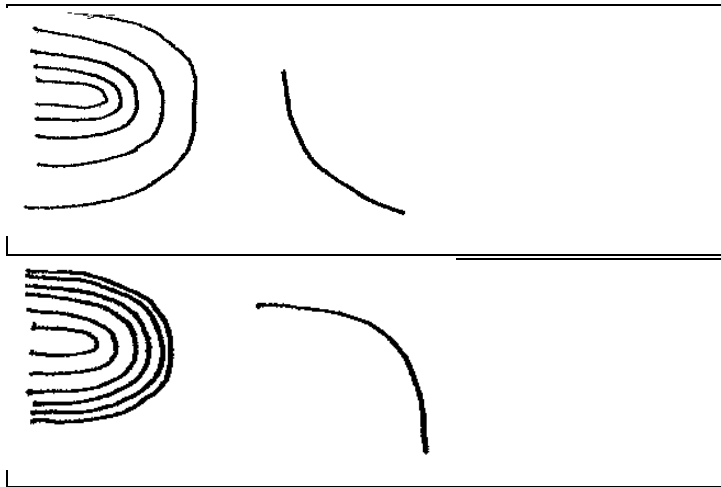
16. Assuming your squad leader follows Route 351 and then Route 42 back to your position, how far must his patrol travel, in meters, from the more northern bridge back to your position at the intersection of Routes 42 and 397?

ANS.

REQUIREMENT 3 SOLUTION

1. 20m with 10m supplementary contour lines
2. Series L654
Sheet 3121 III
3. $2375\text{m} \pm 50\text{m}$
4. Grid Azimuth = 185 degrees
Magnetic Azimuth = 191 degrees
5. 2670m
6. 3
7. 112 degrees
8. $1950\text{m} \pm 50\text{m}$
9. rice paddy, woods, orchard and scrub
10. 6
11. concrete (see legend)
12. $3150\text{m} \pm 50\text{m}$
13. 125 degrees
14. Series 1754
Sheet 3120 I
15. 321 degrees
16. $1300\text{m} \pm 50\text{m}$





DESCRIPTION			ON THE GROUND	ON THE MAP	
HILL	An area of high ground.	Lower ground in all directions from the hilltop.		Closed contour line. Hilltop is within the smallest closed contour.	
FINGER	A sloping line of high ground.	Lower ground in three directions and higher ground in one direction.		Contour lines from "V's" or "U's". The closed ends of "V's" or "U's" point to lower ground.	
SADDLE	A low point between two areas of higher ground.	Lower ground in two directions and higher ground in the opposite two directions.		Contour lines from an "hourglass" shape. The narrow part shows the low area.	
DRAW	A long area of downward sloping low ground.	Lower ground in one direction and higher ground in three directions.		Contour lines from "V's" or "U's". The closed ends of "V's" or "U's" point to higher ground.	
DEPRESSION	An area of low ground.	Higher ground in all directions.		Closed contour lines with tick marks that point in toward lower ground.	
RIDGE	A sloping line of high ground.	Lower ground in three directions and high ground in one direction.		Contour lines tend to be U-shaped or V-shaped. The closed end of the contour points away from high ground.	